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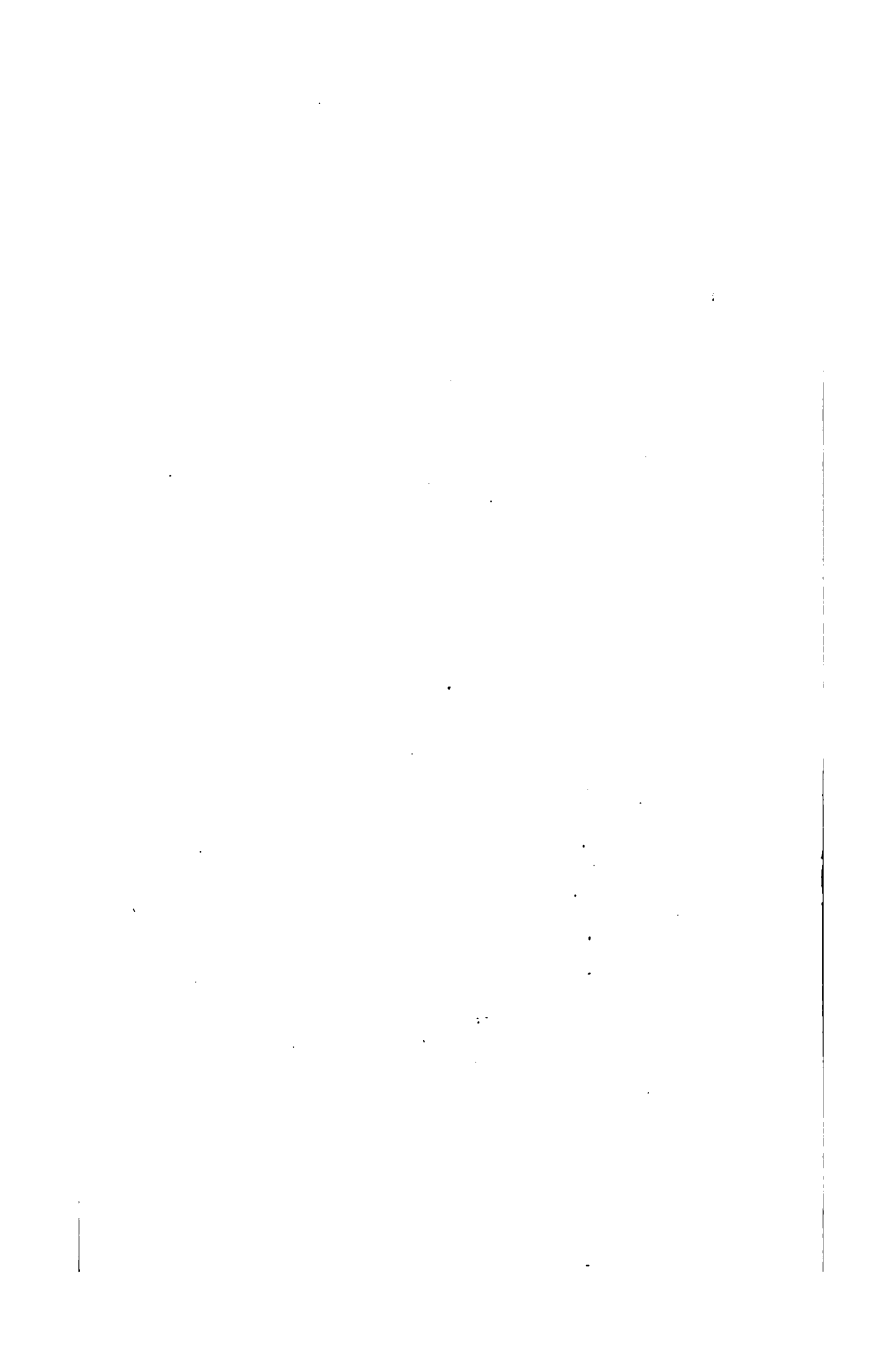
AIDS TO FORENSIC
MEDICINE



DOUGLAS HEMMING

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AIDS
TO
FORENSIC MEDICINE
AND
TOXICOLOGY.

BY

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P R E F A C E.

IN the present volume of the "Aids" Series, the endeavour has been to present the student with a brief epitome of the leading principles and facts of medical jurisprudence, especially selecting those details which he will find useful when preparing for examination and also afterwards when engaged in practice.

The subject is one which students frequently much neglect, from a mistaken idea that it is not important.

If this little work tend in any way to induce students to pay more attention to medico-legal science, its object will be amply attained.

The author would take this opportunity of expressing the obligations he is under to the authors of the larger treatises on the subject, from which this work has been compiled, and would especially mention "Dr. Guy's Forensic Medicine," edited by Dr. Ferrier; Dr. Aubrey Husband's "Student's Handbook of Forensic Medicine;" and the late Dr. Tanner's "Memoranda on Poisons," as being the principal sources from which he has drawn.

36, LADBROKE ROAD, W.

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AIDS TO FORENSIC MEDICINE AND TOXICOLOGY.

Forensic Medicine, Legal Medicine, or Medical Jurisprudence, is that portion of medical science which treats of the connection between law and medicine, and deals with cases connected with the administration of justice, and with questions involving the civil rights and social duties of individuals.

Toxicology is that division of Forensic Medicine which treats of the nature and detection of poisons, and the treatment of poisoned persons.

PART I.

FORENSIC MEDICINE.

I.—MEDICAL EVIDENCE.

We cannot here enter into any lengthened account of the duties of the medical witness, but must refer our readers to larger works on the subject, where they will find very full and explicit directions. We may, however, give a few short rules for the guidance of those who may be called as medical witnesses. The

medical witness should answer questions put to him as clearly and concisely as possible, should make his statements in plain and simple language, avoiding as much as possible technical terms and figurative expressions, and should not quote authorities in support of his opinions.

With regard to notes, these should always be made at the time, on the spot, and may be used by the witness in court as a refresher to the memory, though not altogether to supply its place.

II.—PERSONAL IDENTITY.

It is but seldom that medical evidence is required with regard to the identification of the living, though it may sometimes be so, as in the celebrated Tichborne case. The medical man may in such cases be consulted as to marks on the body, *nævi materni*, scars and tattoo marks, or with regard to the organs of generation in cases of doubtful sex. With regard to scars and their permanence, Casper says, "the scars occasioned by actual loss of substance, or by wounds healed by granulation never disappear. But the scars of leech bites, lancet wounds, or cupping instruments, may disappear after a lapse of time." It is extremely difficult, if not impossible, to give any certain or positive opinion of the age of a scar.

With regard to the identification of the dead in cases of death by accident or violence, the medical man's assistance may be called. The sex of the skeleton, if that only be found, may be judged from the bones of the female generally being smaller and more slender than those of the male, by the female thorax being deeper, the costal cartilages longer, the ilia more expanded, the sacrum more concave, the coccyx movable, turned back, and the tuberosities of the

ischia wider apart, the pubes shallow, and the whole pelvis shallower, and with larger outlets.

Age may be calculated from the cartilages of the ribs, which gradually ossify as age advances; from the skull, the incomplete ossification of which is evidence of childhood; and from the condition of the epiphyses generally, with regard to their attachment to their respective shafts.

In determining stature, if the whole skeleton be laid out and an inch allowed for the soft parts, a fair estimate may be made.

With regard to the determination of cases of doubtful sex in the living, the following points should be noticed: the size of the penis or clitoris, and whether perforate or not, the form of the prepuce, the presence or absence of nymphæ and of testicles. Openings must be carefully sounded as to their communication with bladder or uterus; inquiry should be made as to menstrual or vicarious discharges, and the general development of the body, the growth of hair, the tone of voice, and the behaviour of the individual towards either sex carefully noted.

III.—IMPOTENCE AND STERILITY.

In the male, impotence may arise from physical or mental causes. The physical causes are: too great or too tender an age; malformation of the genital organs; defect or disease in the testicles; constitutional disease or debility. Masturbation, and early and excessive sexual indulgence are also causes. The mental causes include: passion, timidity, apprehension, aversion, and disgust.

In the female, impotence may be caused by narrowness of the vagina; adhesion of the vulva; absence of vagina; imperforate hymen; and tumours of vagina.

Sterility in women may occur from the above named causes of impotence, or from great debility, constant amenorrhœa, dysmenorrhœa, or menorrhagia.

IV.—RAPE.

Physical signs: in the adult the hymen may be ruptured, the fourchette lacerated, and blood found on the parts; in a child there may be no hæmorrhage, but there will be signs of bruising on the external organs. The patient will have difficulty in walking, and in passing water and fæces. These signs last longer in children than in adults. There may be scratches and ecchymoses on the abused person, showing evidence of a struggle.

Semen may be found on the person of the woman, and this will be recognised under the microscope by the presence in it of spermatozoa, minute filamentary bodies having a lashing movement, and with a pear-shaped head.

V.—PREGNANCY.

The signs of the existence of pregnancy are of two kinds, uncertain and certain. Amongst the former class are included: cessation of menstruation—by no means a conclusive sign—morning sickness, salivation, enlargement of the breasts, and of the abdomen, quickening, and the occurrence of kiestein in the urine. The tests which afford conclusive evidence of the existence of a foetus in the uterus, are: ballottement, the uterine souffle, and the pulsation of the foetal heart, all of which will be found described in the larger works on this subject or on midwifery.

Evidence of pregnancy may also be afforded by the discharge from the uterus of an early ovum, of moles, hydatids, &c.

VI.—DELIVERY.

The signs of recent delivery are as follows : the face is pale, with dark circle round the eyes, the pulse is quickened, the skin soft, warm, and covered with a peculiar sweat, the breasts are full, tense and knotty, the abdomen is distended, its integuments relaxed, and there are irregular light streaks on the lower part ; the labia and vagina show signs of distension and injury ; for the first three or four days there is a discharge from the uterus, more or less bloody in character, during the next four or five days it becomes of a dirty green colour, which in a few days more, is succeeded by a yellowish milky mucous discharge continuing for four or five weeks. The uterus may be felt for two or three days above the pubis as a hard round ball. Most of these signs disappear about the tenth day.

In the dead, the external parts have the same appearance as given above. The uterus will vary in appearance according to the time elapsed since delivery. If death occurred immediately after delivery, the uterus will be wide open, about 9 or 10 inches long, with clots of blood inside, and its inner surface lined by decidua.

The signs of a previous delivery consist in silvery streaks in the skin of the abdomen, which however, may be due to distension from other causes ; similar marks on the breasts, jagged condition of the os uteri, marks of rupture of the perineum or fourchette, dark coloured areola round the nipples, &c.

VII.—FETICIDE, OR CRIMINAL ABORTION.

This consists in giving to any woman, or causing to be taken by her, with intent to procure her miscarriage, any poison or other noxious thing, or using for the

same purpose any instrument or other means whatsoever; also in the use of the same means, with the same intent, by any woman being with child. In medicine, an *abortion* is meant when the fœtus is expelled before the sixth month; after that it is *premature birth*. In law, however, any expulsion of the contents of the uterus before the full time is an *abortion* or *miscarriage*. In deciding whether any substance expelled from the uterus is really a fœtus, or is only a mole, or the coat of the uterus, and unconnected with pregnancy, the examination of the woman will be of help; though it is not easy to say whether abortion has taken place or not. The history must be inquired into, and the state of the breasts, the hymen and the os uteri carefully examined. Abortion may be procured by the introduction of instruments, by violent blows, &c., or by the administration of certain drugs, as ergot, savin, pennyroyal, &c.

VIII.—INFANTICIDE.

Infanticide is not treated as a special crime, but is tried by the same rules as in cases of felonious homicide. To constitute "live birth," the child must have been alive after its body was entirely born, and must have had an independent circulation. With regard to the question of maturity of a child, the differences between a child of six or seven months, and one at full term, may be stated as follows:

Between 6th and 7th month: length of child, 10 to 14 inches. Weight: 1 to 4 lbs. Skin, dusky red, covered with down and sebaceous matter; membrana pupillaris disappearing; nails not reaching to ends of fingers; meconium at upper part of large intestine; testes near kidneys; no appearance of convolutions in brain; points of ossification in four divisions of sternum.

At nine months: length of child, 16 to 20 inches. Weight: 4 lbs 5 oz. to 7 lbs. Skin rosy, down about shoulders; sebaceous matter on body; hair about an inch long on head; testes passed inguinal ring; membrana pupillaris disappeared; nails reach to ends of fingers; meconium at termination of large intestine; points of ossification in centre of cartilage at lower end of femur.

IX.—EVIDENCES OF LIVE BIRTH.

The signs of live birth, prior to respiration, are divided into negative and positive. A negative opinion may be formed when evidence is found of the child having undergone intra-uterine maceration. In this case the body will be flaccid and flattened; the ilia prominent; the head is soft and yielding; the cuticle is more or less detached; the skin is of a brownish-red colour, covered with a soapy fluid; the cavities are filled with abundant bloody serum; the umbilical cord straight and flaccid.

A positive opinion may be justified when such injuries are found on the body as could not have been inflicted during birth, and attended with such hæmorrhage as could only have occurred while the blood was circulating.

The evidences of live birth, after respiration has taken place, are usually deduced from the condition of the lungs; though signs are also found in some of the other organs. The lungs, before respiration, are situated at the back of the thorax, and do not fill that cavity; after respiration, they occupy the whole thorax, the portions containing air are of a light-red colour, becoming scarlet, and crepitate under the finger. The weight of the lungs before respiration is about 874 grains, afterwards, 1195 grains; this test, how-

ever, is of scarcely any use. The ratio of the weight of the lungs to that of the body (Ploucquet's test), which, however, is also but little to be relied on, is, before respiration, about 1 to 80; after, 1 to 40. Lungs in which respiration has taken place float in water; those in which it has not, sink. There are exceptions to this rule, on which, however, is founded the hydrostatic test. As originally performed, this consisted merely in placing the lungs, with or without the heart, in water, and noticing whether they sank or floated. This test is now modified by pressure, and by cutting the lungs up into pieces.

The objections to this test, as originally performed, were:—1. That the lungs may sink as the result of disease, *e.g.*, double pneumonia. 2. That respiration may have been so limited in extent that the lungs may sink. 3. Putrefaction may cause the lungs to float when respiration has not taken place. 4. The lungs may have been inflated artificially. Few of these objections apply, however, when the hydrostatic test, modified by pressure, is employed. To apply this, the pressure of the finger and thumb under water may be sufficient; if not, the fragment may be placed in a cloth and the ends twisted opposite ways; if still further pressure be required, the cloth containing the lung may be trodden by the foot.

In addition to the hydrostatic test, live birth may be deduced from the following conditions:—The *stomach* may contain milk or food, recognised by the microscope and by Trommer's test for sugar; the *large intestines* in still-born children are filled with meconium; in those born alive they are usually empty; the *bladder* is generally emptied soon after birth; the *skin* is in a condition of exfoliation soon after birth. The *organs of circulation* undergo the following changes after birth, and the extent to which they go will give an

idea of how long the child has lived:—The *ductus arteriosus* begins to contract within a few seconds of birth; at the end of a week it is about the size of a crowquill, and about the tenth day is obliterated. The *umbilical arteries and vein*:—The arteries are markedly diminished in calibre at the end of 24 hours, and obliterated almost up to the iliacs in three days; the umbilical vein and the ductus venosus are generally completely contracted by the fifth day. The *foramen ovale* becomes obliterated at extremely variable periods, and may continue open even in the adult.

The umbilical cord in a new-born child is fresh, firm, round, and bluish in colour: blood is contained in its vessels. The changes are as follows:—first it *shrinks* from the ligature towards the navel; this change may begin early, and is rarely delayed beyond thirty hours: the cord becomes flabby, and there is a distinct inflammatory circle round its insertion. The next change is that of *desiccation*: the cord becomes reddish-brown, then flattened and shrivelled, then transparent and of the colour of parchment, and falls off about the fifth day. The third stage, that of *cicatrization*, then ensues about the tenth to twelfth day. The bright red rim round the insertion of the cord, with inflammatory thickening and slight purulent secretion, may be considered as positive evidence of live birth.

X.—CAUSE OF DEATH IN THE FŒTUS.

The death of the fœtus may be due to, 1. Its immaturity. 2. Complications occurring during or immediately after birth, which may either be unavoidable or inherent in the process of parturition, or may be induced with criminal intent. Under the former category come such accidents as the pressure of

tumours in the pelvic passages, or disease of the bone in the mother, or pressure on the cord from malposition during labour, by strangulation, from the funis being round the neck, or falls on the floor in sudden labours. Where the death of the fœtus has been induced with criminal intent, it may be due to punctured wounds of the fontanelles, orbits, heart, or spinal marrow ; dislocation of the neck ; separation of the head from the body ; fracture of the bones of the head and face ; strangulation ; suffocation ; drowning ; poisoning ; or omission to tie the umbilical cord.

XI.—LEGITIMACY.

A child born in wedlock is presumed to have the mother's husband for its father. This may, however be open to question upon the following grounds:— Absence or death of the reputed father ; impotence or disease in the husband preventing matrimonial intercourse ; premature delivery in a newly-married woman ; want of access ; when the woman marries again immediately on the death of her husband.

XII.—DURATION OF PREGNANCY.

The natural period of gestation is considered as 40 weeks, 10 lunar months, nine calendar months, or 280 days. This period, however, is not unfrequently exceeded, and, on the other hand, the child may often be born at a shorter term. There is considerable difficulty in many cases in fixing the date of conception. The data from which it is calculated are the following:—1. *Peculiar sensations attending conception*, which are not sufficiently defined to be recognised by those conceiving for the first time. 2. *Cessation of the catamenia*. Other causes may, however, cause this ; and, on the other hand, a woman may menstruate

during the whole period of her pregnancy. This datum also gives a variable period, and may involve an error of at least 12 days. 3. *The period of quickening.* This, when perceived (which is not always the case), also occurs at variable periods from the 10th to the 26th week. 4. *A single coitus.* This is the only really accurate mode of reckoning; but it is, of course, seldom available.

XIII.—VIABILITY OF CHILDREN.

Seven months, or 210 days, is generally considered as the earliest period at which a child can be born capable of living and attaining to maturity. Cases, however, have been recorded in which children born at six months have been reared. The signs of immaturity and maturity may be thus tabulated:—

IMMATURITY.

Centre of body high; head disproportionate in size; membrana pupillaris present; testicles undescended; deep red colour of parts of generation; intense red colour, mottled appearance, and downy covering of skin; nails not formed; feeble movements; inability to suck; necessity of artificial heat; almost unbroken sleep; rare and imperfect discharges of urine and meconium; closed state of mouth, eyelids, and nostrils.

MATURITY.

Strong movements and cries as soon as born; body clear, red colour, coated with sebaceous matter; mouth, nostrils, eyelids, and ears open; skull somewhat firm, and fontanelles not far apart; hair, eyebrows, and nails perfectly developed; testicles descended; free discharge of urine and meconium; power of suction, indicated by seizure of the nipple or a finger placed in the mouth.

XIV.—SUPERFETATION.

By superfetation is meant the conception, by a woman already pregnant, of a second embryo, resulting in the birth of two children, at the same time, differing much in their degree of maturity, or in two separate births,

with a considerable interval between. The possibility of the occurrence of superfœtation has been doubted, but there are some well-authenticated cases which seem to countenance the theory of double conception.

XV.—INHERITANCE.

In order to inherit, the child must be born alive; must be born during the lifetime of the mother; must be born capable of inheriting, that is to say, monsters are incapable of inheriting. There is a mode of inheritance called "tenancy by the curtesy" as follows:—"When a man marries a woman seised of an estate of inheritance, and has, by her, issue born alive, which was capable of inheriting her estate; in this case he shall, on the death of his wife, hold the lands for his life as tenant by the curtesy of England." The meaning of the words "born alive" in this instance is not the same as in cases of infanticide,—any kind of motion being held as evidence of live birth in questions of tenancy by curtesy.

XVI.—FEIGNED DISEASES.

We have not space here to give a long list of feigned diseases, nor to describe all the methods which have been employed to aid deception. The following hints, however, may be useful to a medical man when called to what he believes to be a case of malingering:—Do not be satisfied with one visit only, but come again and enter unannounced; see that the patient is watched between the visits; examine each organ separately, and compare its condition with the statement of the patient, and note any discrepancies between his account of his symptoms and the real symptoms of disease; ask questions the reverse of the patient's statements, or take them for granted, and he will often be

found to contradict himself; have all dressings and bandages removed; suggest, in the hearing of the patient, some heroic methods of treatment, the actual cantery, or some severe surgical operation for example; chloroform will be found of great use in the detection of many sham diseases.

XVII.—MENTAL UNSOUNDNESS.

It will, of course, be impossible for us to enter into any detailed account of so important, difficult, and interesting a subject as insanity. We can only give a few short remarks on the various forms of insanity, with some reference to its legal relations.

According to English law madness absolves a criminal from all guilt, but in order to excuse from punishment on this ground it must be proved that the individual was not capable of distinguishing right from wrong, and that he did not know at the time of committing the crime that the offence was against the laws of *God* and *nature*.

Under the term *non compos mentis* four classes were included by Lord Coke, viz., "1. *Idiota*, which from his nativity, by a perpetual infirmity, is *non compos mentis*. 2. He that by sickness, grief, or other accident wholly loseth his memory and understanding. 3. A lunatic that hath sometimes his understanding and sometimes not, *aliquando gaudet lucidis intervallis*, and, therefore, he is called *non compos mentis*, so long as he hath not understanding. 4. He that, by his own vicious act for a time depriveth himself of his memory and understanding, as he that is drunken."

Various systems of classification have been adopted at the suggestion of different authorities. The one best suited for our purpose is that adopted by Dr. Guy in his "Forensic Medicine," and is as follows:—

UN SOUNDNESS OF MIND.

AMENTIA.	DEMENTIA.	MANIA.
1. Idiocy.	1. Acute or	1. General.
2. Imbecility.	Primary.	{ General. Partial { Monomania. Melancholia.
3. Cretinism.	2. Chronic or Secondary.	
	3. Senile Dementia.	{ General. Partial { Homicidal. Suicidal, &c., &c.
	4. Paralytic Dementia, or General Paralysis of the Insane.	
		3. Moral

XVIII.—IDIOCY, IMBECILITY, CRETINISM.

Idiocy is not a disease, but is a congenital condition in which the intellectual faculties are either never manifested, or have not been sufficiently developed to enable the idiot to acquire an amount of knowledge equal to that acquired by other persons of his own age, and in similar circumstances with himself. Idiots as a rule are deformed in body as well as deficient in mind. Their heads are generally small and badly-shaped, and their features ill-formed and distorted. The complexion is usually sallow and unhealthy; the limbs are imperfectly developed, and their gait is awkward, shambling, and unsteady. In his legal relations an idiot is civilly disabled and irresponsible.

Imbecility is a form of mental defect not usually congenital, but commencing in infancy. The line of demarcation between the imbecile and the idiot may be found in the possession by the former of the faculty of speech, in distinction from the mere parrot-like utterance of a few words, which can be taught the idiot. Imbecility may be intellectual, moral, or general.

Cretinism is a form of amentia, which is endemic in certain districts, especially in some of the valleys of Switzerland, Savoy, and France. The malady is not congenital, but its symptoms usually appear within a few months of birth. The characteristics of this form of idiocy are; an enlarged thyroid gland, constituting a goitre or bronchocele, a high-arched palate, dwarfed stature, squinting eyes, sallow complexion, small legs, conical head, large mouth, and indistinct speech.

XIX.—DEMENTIA; ACUTE, CHRONIC, SENILE, AND PARALYTIC.

In dementia the mental aberration does not occur until the mind has become fully developed, thus differing from amentia, which is congenital, or comes on very early in life.

Acute dementia.—This is a condition of profound melancholy or stupor which arises from sudden mental shock, the mind being, as it were, arrested and fixed in abstraction on the event.

Chronic dementia is generally caused by the gradual action on the mind of grief or anxiety, by severe pain, mania, apoplexy, paralysis, or repeated attacks of epilepsy.

Senile dementia is a form which is incidental to aged persons, and commences gradually with such symptoms as loss of memory for recent events, dulness of perception, and inability to fix the attention. Later on, the reasoning powers begin to fail, and finally, memory, reason, and power of attention are quite lost, the muscular power and force remaining intact. In the last stage there is simply bare physical existence.

Paralytic dementia, general paralysis of the insane.—This is a most interesting form of dementia. Its most prominent and characteristic symptom consists in de-

lusions of great power, exalted position, and unlimited wealth. It is accompanied by progressive bodily and mental decay. Women are rarely affected by it, and it generally commences in men about middle age, and lasts from a few months to three years. Paralytic symptoms first appear in the tongue, lips, and features; the speech becomes thick and hesitating. The paralytic symptoms gradually go on increasing, the sphincters refuse to act, and death may occur from suffocation and choking. Sometimes, during the early stages especially, there may be maniacal paroxysms or epileptic fits. The delusions remain the same throughout, the patient always expresses himself as being happy, and his last words will probably have reference to money and his other large delusions.

XX.—MANIA.

Under the term mania are included all those forms of mental unsoundness in which there is undue excitement. It is divided into general, intellectual, and moral, and each of the two latter classes again into general and partial.

General mania affects the intellect as well as the passions and emotions. Mania is usually preceded by an incubative period in which the patient's general health is affected. The duration of this period may vary from a few days to 15 or 20 years. When the disease is established, the patient has paroxysms of violence directed against himself, as well as others; he tears his clothes to pieces, either abstains from food and drink or eats voraciously, and sustains immense muscular exertion without apparent fatigue. The face becomes flushed, the eye wild and sparkling; there is pain, weight, and giddiness in the head, with restlessness.

General intellectual mania, attacking the intellect

alone, is rare ; but some one emotion or passion, as pride, vanity, or love of gain may obtain ascendancy, and fill the mind with intellectual delusions.

Partial intellectual mania or *monomania*, also called *melancholia*, is a form of the disease in which the patient becomes possessed of some single notion, contradictory alike to common sense and his own experience.

General moral mania.—Prichard thus defines moral mania :—"A morbid perversion of the natural feelings, affections, inclinations, temper, habits, moral dispositions, and natural impulses, without any remarkable disorder or defect of the intellect, or knowing and reasoning faculties, and particularly without any insane illusion or hallucination."

Partial moral mania.—In this form one or two only of the moral powers are perverted. There are several forms of this, viz. :—

Kleptomania, a propensity to theft. More common in women in easy circumstances.

Dipsomania, an insatiable desire for drink.

Erotomania, or amorous madness. When occurring in women this is also called *Nymphomania*, and in men, *Satyriasis*. It consists in an uncontrollable desire for sexual intercourse.

Pyromania, an insane impulse to set fire to everything.

Homicidal mania, a propensity to murder.

Suicidal mania, or propensity to self-destruction. Some consider suicide as always a manifestation of insanity.

Puerperal mania.—This form of mania attacks women soon after confinement. There is in many cases a strong homicidal tendency against the child.

Mania with lucid intervals.—In many cases mania is

intermittent, or recurrent, in its nature, the patient in the interval being in his right mind.

XXI.—EXAMINATION OF PERSONS OF UNSOUND MIND.

The following hints with regard to the examination of patients supposed to be insane will be useful. The general appearance and shape of head, complexion and expression of countenance, gait, movements, and speech should be carefully noted. The state of the general health, appetite, bowels, tongue, skin, and pulse should be enquired into ; and in women the state of the menstrual function must be noticed. The family history must be traced out, and the personal history taken with care, as to whether the unsoundness came on late in life or followed any physical cause. Ascertain whether this is a first attack, whether the patient has suffered from epilepsy, has squandered his money, grown restless, had large delusions, &c., &c. In order to ascertain the capacity of the mind, questions should be asked with regard to age, birthplace, profession, number of family, common events, day of week, month and year, name of sovereign, &c. The power of performing simple arithmetical operations may be tested. More than one visit should be made. In signing lunacy certificates it must be remembered that the medical man is required to see the patient by himself, to sign the certificate at the time of his visit, and to assign his reasons for signing it.

XXII.—EXAMINATION OF PERSONS FOUND DEAD.

When a medical man is called to a case of sudden death, he should carefully note anything likely to throw any light on the cause of death. He should also notice the place where the body was found, the

position and attitude of the body, the soil or surface on which the body lies, the position of surrounding objects, and the condition of the clothes.

If required to make a post-mortem examination, every cavity and important organ of the body must be carefully and minutely examined, the seat of injury being inspected first.

XXIII.—MODES OF SUDDEN DEATH.

There are three modes in which death may occur,—by syncope, asphyxia, and coma.

Syncope, or arrest of the heart's action, may occur from—1. Deficiency of blood, due to hæmorrhage. 2. The effects of certain diseases and poisons. The P.M. signs of this mode of death are: A normal quantity of blood in the heart; blood in the veins and arteries; no engorgement of brain and lungs.

Asphyxia, or *apnœa*, death from impediment to the action of the lungs, caused by—1. Certain diseases of the lungs. 2. Mechanical obstruction to respiration. P.M. shows engorgement of the pulmonary artery, right cavities of heart and *venæ cavæ*, the left side of the heart and the aorta, &c., being comparatively empty.

Coma.—Death due to some cerebral mischief, caused by apoplexy, fracture of the cranial bones, compression, &c. The P.M. signs are congestion of the membranes and substance of the brain and lungs, with more or less blood in the right cavities of the heart.

XXIV.—SIGNS OF DEATH.

1. *Cessation of the circulation and respiration*, no murmur being heard by the stethoscope. 2. *The state of the eye*, in which there is a tenacious glairy mucus on the conjunctiva with a collapsed and wrinkled state of the cornea. 3. *Absence of sense and motion*; these occur in suspended animation. 4. *The facies Hip-*

pocratica—Not a safe sign, being frequently absent in sudden death. 5. *The state of the skin*; pallor, livid discolorations, and loss of elasticity, have been mentioned among the signs of death. 6. *Extinction of muscular irritability*. The above signs afford no means of determining how long life has been extinct. The following, however, do: *Extinction of animal heat*: the average internal temperature of the body is from 98° to 100° F. The time taken in cooling is from 15 to 20 hours, but it may be modified by circumstances. *Cadaveric rigidity—Rigor mortis*. For some time after death the muscles continue to contract under stimulus. When this irritability ceases, and it seldom exceeds two hours, rigidity sets in. It is caused by the coagulation of the muscle fibrin. It commences in the muscles of the back of the neck and lower jaw, and then passes into the muscles of the face, front of the neck, chest, upper extremities, and lastly to the lower extremities. It lasts from 16 to 20 hours, or more. In lingering diseases it sets in quickly, and disappears in two or three hours; in those who are in perfect health and die from accident it does not come on until from 10 to 24 hours, and may last two or three days. This is also the case in poisoning by strychnia.

Putrefaction appears in from one to three days after death, as a greenish blue discolouration of the abdomen. This increases, becoming darker and more general, a strong putrefactive odour is developed, the thorax and abdomen become distended with gas, and the epidermis peels off. The muscles then become pulpy and assume a dark greenish colour, the whole body at length becoming changed into a soft, semi-fluid mass. The organ which resists putrefaction longest is the uterus. These putrefactive changes are modified by the fat or lean condition of the body, the temperature (putrefaction taking place

more rapidly in summer than in winter) access of air, the period, place, mode of interment, age, &c.

Saponification. In bodies which are very fat and have lain in water or moist soil for from one to three years this process takes place, the fat uniting with the ammonia given off by the decomposition to form *Adipocere*. This consists of a margarate of ammonia with lime, oxide of iron, potash, certain fatty acids, and a yellowish odorous matter. It has a fatty unctuous feel, is either pure white or pale yellow with an odour of decayed cheese.

XXV.—DEATH BY DROWNING.

Death by drowning occurs when breathing is arrested by watery or semi-fluid substances, blood, urine, mud, &c. The fluid acts mechanically by entering the air-cells of the lung and preventing the due oxidation of the blood. The post-mortem appearances include those usually present in death by apnoea (Aid xxiii.), and also the following, peculiar to death by drowning: Excoriations of the fingers, with sand or mud grasped in the nails: fragments of plants grasped in the hand; water in the stomach; froth at the mouth and nostrils; froth, water, and sand, or mud, in the air passages; cutis anserina, and contraction and retraction of the penis. The last is a very constant and valuable sign.

XXVI.—DEATH BY HANGING.

In hanging, death occurs by apnoea, as in drowning; or from the force of the fall dislocating or fracturing the cervical vertebræ, or the odontoid process. Sensibility is soon lost in hanging, and death is complete in four or five minutes. The countenance is livid, swollen, and distorted, the eyes brilliant and staring, tongue swollen and livid, blood or bloody froth is found about the mouth and nostrils, the hands are clenched,

a deep and ecchymosed mark shows the course of the cord, and on dissection the muscles and ligaments of the windpipe are found stretched, bruised, or torn, and the inner coats of the carotid arteries are sometimes found divided.

XXVII.—DEATH BY STRANGULATION.

This differs from hanging, in that the body is not suspended. It may be affected by a ligature round the neck, or by direct pressure on the windpipe. In strangulation more force is required to be used, and therefore the mark on the neck will be more distinct, and the injury to the subjacent parts greater.

XXVIII.—DEATH BY SUFFOCATION.

This includes all cases of apnoea not produced by direct pressure on the windpipe, except drowning. Suffocation may take place from—1. Stoppage of the mouth and nose by accident or force. 2. Mechanical pressure on the chest. 3. Closure of the glottis, as by food. 4. Vapours, as the vapour of charcoal. 5. Strychnia, which, by contracting the muscles of the chest, produces death by suffocation.

In some cases of death by suffocation there are no external marks; but internally there are the signs of asphyxia, with unusual fluidity of the blood.

XXIX.—WOUNDS AND MECHANICAL INJURIES.

A wound may be defined, according to Dr. Taylor, as “a breach of continuity in the structures of the body, whether external or internal, suddenly or occasioned by mechanical violence.” This large subject of wounds will be considered under various heads.

XXX.—CONTUSED WOUNDS AND INJURIES UNACCOMPANIED BY SOLUTION OF CONTINUITY.

If a blow be inflicted with a blunt instrument, there is produced a bruise or *ecchymosis*. It is unnecessary here to describe the appearance and progress of a bruise, which will be found described in any work on surgery. It may be necessary to distinguish between bruises inflicted during life and after death. In bruises inflicted during life the skin is dark, discoloured, and thickened by the infiltration of blood into its whole thickness. If on cutting into the bruise, the effusion of blood is considerable and the clots large, the presumption is strongly in favour of its having been inflicted during life.

XXXI.—INCISED WOUNDS, AND THOSE AC- COMPANIED BY SOLUTION OF CONTINUITY.

These comprise incised, punctured, and lacerated wounds. In a recent incised wound, inflicted during life, there is copious hæmorrhage, the cellular tissue is filled with blood, the edges of the wound are united with coagula between. The distinction between incised wounds inflicted during life and after death, may be found in the fact, that in a wound inflicted during life, there are the above characters; whereas, in a post-mortem incised wound, a small quantity of liquid venous blood is effused; no clots are found; the edges are close, yielding, inelastic; the blood is not effused into the cellular tissue, and there are no signs of inflammation.

Lacerated wounds combine the characters of incised and contused wounds.

Punctured wounds come intermediate between incised and lacerated. They cause little hæmorrhage, and heal usually by suppuration.

XXXII.—GUNSHOT WOUNDS.

These are either contused or lacerated wounds. Round balls make a larger opening than conical ones. Small shot, if fired near, make one large, ragged, opening. The contents of all gunshot wounds should be preserved, as they may be useful in evidence. When the bullet traverses the body, two apertures will be found. The aperture of entrance is round and clean, that of exit less regular and jagged.

XXXIII.—WOUNDS OF DIFFERENT PARTS OF THE BODY.

1: *Of the head.*—Wounds of the scalp are particularly likely to cause erysipelatous or diffuse inflammation. A severe blow on the vertex may cause fracture of the base of the skull. Injuries of the brain include concussion, compression, wounds, and inflammation. Concussion is a common effect of blows or violent shocks, and the symptoms follow immediately on the accident, death sometimes taking place without reaction. Compression may be caused by depressed bone or effused blood and serum. The symptoms may come on suddenly or gradually. Wounds of the brain present very great difficulties, and vary greatly in their effect; very slight wounds producing severe symptoms, and *vice versâ*. Inflammation may follow injuries not only to the brain itself, but to the scalp and adjacent parts, as the orbit and ear. Inflammation does not usually come on at once, but after a variable period.

2. *Injuries to the spinal cord* may be concussion, compression, or wounds. Serious injury to the cord generally proves fatal immediately, or speedily, if in the upper part, by paralysis of the muscles of respiration. If the injury be in the lumbar or dorsal region, there is loss of power and sensation below the seat of injury, with retention of urine and escape of fæces.

3. *Of the face.*—These produce great disfigurement and inconvenience, and there is a risk of injury to the brain.

4. *Of the throat.*—Very frequently inflicted by suicides. Division of the carotid artery is fatal, and of the internal jugular vein very dangerous. Wounds of the larynx and trachea are little dangerous.

5. *Of the chest.*—Incised wounds of the walls are not very dangerous; but severe blows, by causing fracture of the bones and internal injuries, are often fatal.

6. *Of the lungs.*—These cause hæmorrhage, and inflammation very frequently.

7. *Of the heart.*—Penetrating wounds are fatal from hæmorrhage, and of the base more speedily than of the apex.

8. *Of the aorta and pulmonary artery.*—Fatal.

9. *Of the œsophagus and thoracic duct.*—Very rare.

10. *Of the diaphragm.*—Generally dangerous from hernia of the stomach.

11. *Of the abdomen.*—Of the walls may be dangerous from division of the epigastric artery; ventral hernia may occur.

12. *Of the Liver.*—May divide the large vessels. Wounds of the gall-bladder cause effusion of bile and peritoneal inflammation.

13. *Of the spleen.*—Deep wounds are fatal from hæmorrhage.

14. *Of the stomach.*—May be fatal from shock, from hæmorrhage, from extravasation of contents, or from inflammation.

15. *Of the intestines.*—May be fatal in the same way as those of the stomach. More dangerous in the small than in the large intestines.

16. *Of the kidneys.*—May prove fatal from hæmorrhage, extravasation of urine, or inflammation.

17. *Of the bladder.*—Dangerous from extravasation of urine.

18. *Of genital organs.*—Removal of penis may produce fatal hæmorrhage; if not, it is not dangerous. Removal of testicles may prove fatal from shock to nervous system. Wounds of the spermatic cord may be dangerous from hæmorrhage.

XXXIV.—DETECTION OF BLOOD STAINS.

Stains may require detection on clothing, or cutting instruments, on floors, and furniture, &c. The following table from Dr. Aubrey Husband's "Hand-book of Forensic Medicine," gives the various distinctive characters of blood-stains.

(a) *Ocular inspection.* — Blood-stains on dark-coloured materials, which, in daylight, might be easily overlooked, may be readily detected by the use of artificial light, as that of a candle brought near the cloth. Blood-spots, when recent, are of a bright-red colour, if arterial; of a purple hue, if venous; the latter becoming brighter on exposure to the air. After a few hours, blood-stains assume a reddish-brown tint, which they maintain for years.

(b) *Microscopic demonstration.* With the aid of the microscope, blood may be detected by the presence of the characteristic blood-corpuscles.

(c) *Action of water.* Water has a wonderfully solvent action on blood, the stains rapidly dissolving when the material on which they occur is placed in cold water; a bright-red solution being formed. Rust is not soluble in water.

(d) *Action of heat.*—Blood-stains on knives, &c., may be removed by heating the metal, when the blood will peel off, at once distinguishing it from rust. Should the blood-stain on the metal be long exposed

to the air, rust may be mixed with the blood, when the test will fail. The solution obtained in water is coagulated by heat, the colour entirely destroyed, and a flocculent muddy-brown precipitate formed.

(e) *Action of caustic potash.* The solution of blood obtained in water is boiled, when a coagulum is formed, soluble in caustic potash; the solution formed being greenish by transmitted, and red by reflected light.

(f) *Action of nitric acid.*—Nitric acid added to a watery solution, produces a whitish grey precipitate.

(g) *Action of guaiacum.*—Tincture of guaiacum produces in the watery solution a reddish-white precipitate of the resin; but on addition of an ethereal solution of peroxide of hydrogen, a blue colour is developed.

(h) *Hæmin crystals.*—These are produced by heating a drop of blood, or a watery solution of it with glacial acetic acid in a watch glass, and evaporating the mixture. Crystals of hæmin may be detected by the microscope in the residue. They are rhomboidal, tubular, or otherwise, of a yellowish, yellowish-red, or dirty blood-red colour. If the stain is old, salt should be added to the acetic acid solution.

(i) *Spectroscopic appearances.*—Two dark absorption bands appear, situated at the junction of the yellow with the green rays, and in the middle of the green rays of the spectrum. The spectrum of alkanet root in solution of alum differs only from that of recent blood in having a third absorption band between the green and the blue.

There is no means of detecting menstrual blood from human blood the result of a wound.

XXXV.—DEATH FROM STARVATION.

The post mortem appearances in death from starvation are as follows: There is marked general emacia-

tion; the skin is dry and shrivelled; the muscles soft, small, and free from fat; the liver is small, and all the internal organs are shrivelled and bloodless. The stomach is sometimes quite healthy; in other cases it may be collapsed, empty, and with more or less ulceration of the mucous membrane. The intestines are also contracted and empty, and may be so much shrunk that the canal may be almost obliterated.

“These appearances are not so characteristic as to be decisive of the mode of death; but in the absence of any disease productive of extreme emaciation, such a state of body will furnish a strong presumption of death by starvation.” (Guy).

PART II.

TOXICOLOGY.

I.—DEFINITION OF A POISON.

A POISON is any substance or matter, (solid, liquid, or gaseous) which, when applied to the body outwardly, or in any way introduced into it, without acting mechanically, but by its own inherent qualities, can destroy life.

II.—CLASSIFICATION OF POISONS.

Various attempts have been made to devise a satisfactory system of classification, but without much success. The following is that adopted by Dr. Guy.

1. Inorganic. {Corrosive. Irritant.	2. Organic. {Irritant. Affecting brain. ,, spinal cord. ,, heart. ,, lungs.
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The most important poisons of these two classes are,—
inorganic: arsenic, salts of lead, mineral acids, salts of mercury. *Organic*: laudanum, opium, morphia, Godfrey's cordial, prussic acid, oil of bitter almonds, cyanide of potassium, oxalic acid, strychnia and nuxvomica.

III.—EVIDENCE OF POISONING.

It may be inferred that poison has been taken by a person from an examination of the following circumstances :—Symptoms and post-mortem appearances, experiments on animals, chemical analysis, and the conduct of suspected persons.

1. *Symptoms*.—In poisoning usually come on suddenly when patient is in good health, and soon after taking a meal, drink or medicine ; many diseases, however, come on suddenly, and in cases of slow poisoning, the invasion of the symptoms may be gradual. 2. *Post-mortem appearances*. These in many poisons and classes of poisons are perfectly characteristic and unmistakable. The p. m. appearances peculiar to the various poisons will be described under their respective names. 3. *Experiments on animals*. These are valuable, but they cannot always be taken as conclusive. The dog and the cat are the animals most nearly resembling man with respect to the effects produced by poisons. 4. *Chemical analysis*. This is, perhaps, the most important form of evidence, as a demonstration of the actual presence of a poison in the body must carry immense weight. The poison may be discovered in the living person, by testing the urine, the blood abstracted by bleeding, leeches or cupping, or the serum of a blister. In the dead body it may be found in the blood, flesh, viscera, and secretions. Its discovery in these cases must be taken as conclusive evidence of administration. If, however, it be found only in substances rejected or voided from the body, the evidence is not so conclusive, as it may be contended that the poison was introduced into the substance examined after its rejection from the body, or if the quantity be very small it will be argued that it is not sufficient to cause death.

5. *Conduct of suspected persons.*—A prisoner may be proved to have purchased poison, to have made a study of the properties and effects of poisons, to have made medicines or prepared food for the deceased, to have made himself the sole attendant of the deceased, to have placed obstacles in the way of obtaining proper medical assistance, to have removed substances which might have been examined, &c.

IV.—SYMPTOMS AND POST-MORTEM APPEARANCES OF DIFFERENT CLASSES OF POISONS.

1. *Corrosives.*—Characterised by their destructive action on parts with which they come in contact. The principal inorganic corrosives are the mineral acids, the caustic alkalies and their carbonates; and of the organic, strong solutions of oxalic acid, and of tartaric and citric acid.

Symptoms.—Burning pain in mouth, throat, and gullet, strong acid, metallic, or alkaline taste, retching and vomiting, the discharged matters containing shreds of mucus, blood, and the lining membrane of the passages. Inside of mouth corroded. There is also dysphagia, thirst, dyspnoea, small and frequent pulse, anxious expression, &c.

Post-mortem appearances.—Those of corrosion with corrugation from strong contraction of muscular fibres, and followed by inflammation and its consequences. The mouth, gullet, and stomach, and in some cases the intestines are white, yellow, and brown, shrivelled and corroded. The corrosions may be small, or may extend over a very large surface. Sometimes considerable portions of the lining membrane of the gullet or stomach may be discharged by vomiting or by stool. Beyond the corroded parts the textures are acutely inflamed.

The stomach is filled with a yellow, brown, or black gelatinous liquid or black blood, and may in rare cases be perforated.

2. Irritants.—These are substances which inflame parts to which they are applied. The class includes mineral, animal, and vegetable substances, and contains a larger number of poisons than all the other classes together. Irritants may be divided into two groups. 1. Those which destroy life by the irritation they set up in the parts to which they are applied. 2. Those which add to local irritation peculiar or specific remote effects. The first group includes the principal vegetable irritants, some alkaline salts, some metallic poisons, &c., and the second comprises the metallic irritants, the metalloids, phosphorus and iodine, and one animal substance, cantharides.

Symptoms.—Burning pain and constriction in throat and gullet; pain and tenderness of stomach and bowels, intense thirst, nausea, vomiting, purging and tenesmus with bloody stools; dysuria, cold skin and feeble and irregular pulse. Death may occur from shock, convulsions, collapse, exhaustion, or from starvation on account of the injury to the œsophagus.

Post-mortem appearances.—Those of inflammation and its consequences. Coats of stomach, fauces, gullet, and duodenum may be thickened, black, ulcerated, gangrenous and sloughing. Vessels filled with dark blood ramify over the surface. Acute inflammation is often found in the small intestines with ulceration and softening of mucous membrane.

3. Poisons acting on the brain.—Three classes; the opium group, producing sleep; the belladonna group, producing delirium and illusions; and the alcohol group, causing exhilaration followed by delirium or sleep.

Symptoms.—Of the opium group: giddiness, headache, dimness of sight, contraction of pupil, noises in the ears, drowsiness and confusion, passing into insensibility. Of the belladonna group: delirium, spectral illusions, dilated pupils, dry mouth, thirst. Rarely there may be tetanic spasms, paralysis, &c.

Of the alcohol group: excitement of circulation and of cerebral functions, want of power of co-ordination, and of muscular movement, double vision, followed by profound sleep, and coma. In the chronic form delirium tremens.

Post-mortem appearances.—In the opium group: fullness of the sinuses and veins of the brain, with effusion of serum into the ventricle and beneath the membranes. In the belladonna group: nil. In alcohol group: signs of inflammation, congestion of brain and membranes, fluidity of blood, long-continued rigor mortis.

4. *Poisons acting on spinal cord.*—Strychnia, &c. Leading symptom is tetanic spasm.

5. *Poisons affecting the heart.*—These kill by sudden shock, syncope, or collapse. They comprise, prussic acid, oxalic acid and the oxalates, aconite, digitalis, tobacco, &c.

6. *Poisons acting on the lungs.*—These have for the type carbonic acid gas.

V.—DUTY OF PRACTITIONER IN SUPPOSED CASE OF POISONING.

If called to a case supposed or suspected to be one of poisoning, the medical man has two duties to perform: to save the patient's life, and to assist justice. Of the preservation of life the next "Aid" will treat. If he find life extinct his duty is only to see that justice is done. For this purpose he makes inquiries as to symptoms, time at which food or medicine was last

taken, &c. He must take possession of any food, medicine, vomited matter, urine or fæces in the room, and seal them up in clean vessels for examination. He must then notice the position and temperature of the body, the condition of rigor mortis, marks of violence, appearance of gullet and mouth, and in making a post-mortem examination, the alimentary canal must be removed and preserved for further investigation. A double ligature should be passed round the cesophagus in the chest, and also round the duodenum a few inches below the pylorus. The gut and the gullet being cut across between these ligatures, the stomach may be removed entire without spilling its contents. The intestines may be removed in a similar way, and the whole or a portion of the liver should also be preserved. These should all be put in separate jars without any preservative fluid, tied up, sealed, labelled, and initialed. All observations should be committed as soon as possible to writing.

VI. TREATMENT OF POISONING.

The modes of treatment may be ranged under three heads. 1. To get rid of the poison. 2. To stop its action. 3. To avert the tendency to death.

1. The first indication is met by the administration of emetics, to cause vomiting, or by the use of the stomach-pump. It will be seen further on in what cases respectively these two methods are admissible. Of emetics, sulphate of zinc in 20 grain doses is about the best. In narcotic poisoning sulphate of copper in eight or ten grain doses will sometimes act when other emetics have failed. Ipecacuanha wine (drachms six to eight) is sometimes useful. A teaspoonful or two of mustard in warm water frequently repeated is often an efficient substitute for the above, as is common salt

occasionally. Tickling the fauces with a feather will also excite vomiting.

2. The second indication is met by the administration of an antidote. The various antidotes will be mentioned under their respective poisons.

3. To fulfil this indication we must endeavour to palliate the symptoms, and neutralise the after effects of the poison on the constitution. In the case of narcotics and depressing agents, stimulants, galvanism, cold affusion, &c., will be desirable. Thus, injection of ammonia into the veins has been found useful by Halford and others in cases of snake bites. We must also endeavour to promote the elimination of the poison from the body by exciting the secreting functions.

VII.—DETECTION OF POISONS.

Notice the smell, colour, and general appearance of the matter submitted for examination. The odour may show the presence of prussic acid, alcohol, opium, or phosphorus. The colour may indicate salts of copper, cantharides, &c. Seeds of plants may be found.

This examination having been made, the contents of the alimentary canal, and any other substances to be examined, must be submitted to chemical processes. They are generally mixed, though the pure substance may sometimes be submitted to the analyst.

Simple filtration will sometimes suffice to separate the required substance; in other cases dialysis will be necessary, in order that crystalloid substances may be separated from colloid bodies. In the case of volatile substances distillation will be required.

For the separation of an alkaloid the following is the process of Stas:—1. Treat the organic matter with twice its weight of absolute alcohol, to which from ten to thirty grains of tartaric or oxalic acid has been added, and subject to a gentle heat. 2. The

residue, after filtration and drying, is dissolved in a small quantity of distilled water, treated with bicarbonate of soda, and the alkaloid set free. 3. The resulting liquid, holding the alkaloid in solution or suspension, is mixed with four or five times its bulk of ether, chloroform, or benzole, briskly shaken, and left to rest. The ether floats on the surface, holding the alkaloid in solution. 4. A part of this ethereal solution is poured into a watch-glass and allowed to evaporate. If the alkaloid be volatile, oily streaks will appear on the glass; if not volatile, some crystalline traces will be visible. If a volatile alkaloid, add 20 or 30 grains of strong solution of caustic potash or soda; draw off the ethereal solution with a pipette, and shake with water acidulated with sulphuric acid. The ether being again drawn off, the alkaloid is left as a sulphate. This liquid is again treated with potash or soda and ether, and the ether being again evaporated the alkaloid is left sufficiently pure.

If a fixed alkaloid, treat similarly with soda, or potash and ether, as above, and evaporate, when the solid alkaloid will be left in an impure state. To purify it add a small quantity of dilute sulphuric acid, and after evaporating to $\frac{3}{4}$ of its bulk add a saturated solution of carbonate of potash or soda. Absolute alcohol will then dissolve out the alkaloid and leave it on evaporation in a crystalline form.

In order to isolate an inorganic substance from organic matter Fresenius' method is adopted: Boil the finely divided substance with about $\frac{1}{8}$ its bulk of pure hydrochloric acid; add from time to time potassic chlorate, until the solids are reduced to straw-yellow fluid. Treat this with excess of bisulphite of soda, then saturate with sulphuretted hydrogen until metals are thrown down as sulphides. These may be collected and tested.

For the detection of minute quantities the microscope must be used, and Guy's and Helwig's method of sublimation will be found very advantageous. Crystalline poisons may be recognised by their characteristic forms.

VIII.—THE MINERAL ACIDS.

These are Sulphuric, Nitric, and Hydrochloric acids.

Symptoms of poisoning by the mineral acids.—

Sour taste in the mouth, with violent burning pain extending into the œsophagus and stomach, and commencing immediately on the poison being swallowed; eructations, constant retching, and vomiting of brownish and blackish matter containing blood, coagulated mucus, epithelium or portions of the lining membrane of the gullet and stomach. There is constipation, scanty or suppressed urine, tenesmus, small and frequent pulse; the lips, tongue, and inside of the mouth are shrivelled and corroded. Exhaustion succeeds, and the patient dies either collapsed, convulsed, or suffocated, the intellect remaining clear to the last. In chronic poisoning by the mineral acids there is fever, dry skin, frequent pulse, vomiting of food mixed with flakes of false membrane or of lining membrane of gullet and stomach, salivation, tenseness of abdomen, short and difficult breathing, impaired digestion, emaciation.

Post-mortem appearances common to the mineral acids.—Stains and corrosions about the mouth, chin, fingers, &c. wherever the acid has come in contact. The inside of the mouth, fauces and œsophagus, is white and corroded or dark-brown and shrivelled. Epiglottis contracted or swollen. Stomach distended with gas and filled with brown, yellow, or black glutinous liquid; its lining membrane is charred or inflamed, and the vessels injected. Pylorus contracted.

Perforation, when it takes place, is posterior, the apertures are circular, and surrounded by inflammation and black extravasation. The blood in the large vessels may be coagulated.

Treatment.—Calcined magnesia, or the carbonate or bicarbonate of soda, mixed with milk or some mucilaginous liquid are the best antidotes. In the absence of these, chalk, whiting, plaster from a ceiling, milk, oil, soap-suds, &c. will be found of service. The stomach pump should *not* be used. If the acid have got into the larynx and impede the breathing, tracheotomy may be necessary. Injuries of external parts by the acid must be treated as burns.

IX.—SULPHURIC ACID.

SULPHURIC ACID, or oil of vitriol, is met with concentrated or diluted. Besides its use as an internal poison it is frequently thrown over the person to disfigure the features or destroy the clothes. Parts of the body touched by it are stained, first white, and then dark-brown or black. Black woollen cloth it turns to a dirty brown, the edges of the spots becoming red in a few days.

Tests.—Concentrated acid chars organic matter; evolves heat when added to water, and sulphurous fumes when boiled with chips of wood, copper cuttings or mercury. Dilute acid chars paper; gives a white precipitate with nitrate of barium; and is entirely volatilised by heat.

Symptoms, p.m. appearances and treatment. Aid viii.

Fatal dose.—In an adult, one drachm.

Fatal period.—(*Shortest.*) One hour.

X.—NITRIC ACID.

NITRIC ACID, aqua fortis, or red spirit of nitre is not so much used as a poison as sulphuric.

Tests.—Concentrated acid gives off irritating orange-coloured fumes, (nitrous acid gas). When poured on

copper it gives off red fumes, and leaves a green solution of nitrate of copper. It strikes a red colour with morphia, turns green sulphate of iron black, and with hydrochloric acid dissolves gold. The skin it turns bright yellow, and does the same with woollen clothes.

Symptoms, p.m. appearances, and treatment, Aid viii.

Fatal dose.—Two drachms.

Fatal period.—(*Shortest.*) One hour and three quarters in an adult.

XI.—HYDROCHLORIC ACID.

HYDROCHLORIC ACID, muriatic acid, or spirit of salt, is not often employed as a poison.

Tests.—Concentrated acid fumes in moist air, and yields dense white vapours with ammonia. When boiled with black oxide of manganese, it gives off chlorine, recognised by its smell and bleaching properties. Diluted, it gives a white precipitate with nitrate of silver, which is insoluble in nitric acid, and in caustic potash, but is soluble in ammonia, and when dried and heated, melts, and forms a horny mass.

Symptoms, p.m. appearances, and treatment. Aid viii.

Fatal dose.—Half an ounce.

Fatal period.—(*Shortest.*) Five hours and a half.

Nitric and sulphuric acids, mixed, form aqua reginæ, used to dissolve silver, and nitric and hydrochloric acids mixed form aqua regia, used to dissolve gold and platinum.

XII.—ALKALIES.

It is rare to find cases of poisoning by the alkalies. They possess the property, like the mineral acids, of destroying animal tissues with which they come in contact. No specific remote effects are produced.

XIII.—POTASH.

POTASH occurs usually as caustic potash, liquor potassæ, carbonate, bicarbonate, or salt of tartar (potashes and pearlash).

CAUSTIC POTASH is soapy to the touch, has an acrid taste, is deliquescent, fusible by heat, soluble in water, and gives a violet tint to the blowpipe flame.

LIQUOR POTASSÆ has a strong alkaline reaction, and yields a yellow precipitate with bichloride of platinum.

CARBONATE OF POTASH, *bicarbonate of potash* or *salt of tartar* occurs in two forms. 1. A mottled deliquescent, grey, yellow, or brown mass, strongly alkaline: this is called *potash* or *potashes*. 2. In small grains or a white semi-crystalline mass: *pearlash*.

Symptoms.—Acrid taste in mouth, burning in throat and gullet, acute pains at pit of stomach, vomiting of bloody mucus, colicky pains, bloody stools, surface cold, pulse weak. In chronic cases death occurs from stricture of the œsophagus, causing starvation.

Post-mortem appearances.—Softening, inflammation and corrosion of mucous membrane of mouth, pharynx, œsophagus, stomach and intestines. Inflammation may have extended to larynx.

Treatment.—Vinegar and water, lemon-juice and water, acidulated stimulant drinks, oil, linseed tea, &c., opium to relieve pain, stimulants in collapse. *Not* stomach pump.

Fatal dose.—Half an ounce.

Fatal period.—(*Shortest*.) Three hours.

XIV.—SODA.

CARBONATE OF SODA occurs as *soda* and *best soda*. Alkaline reaction, effervesces and evolves carbonic acid when treated with an acid; crystallises, gives yellow tinge to blowpipe flame. No precipitate with tartaric acid, nor with bichloride of platinum.

Symptoms, post-mortem appearances, and treatment as potash.

XV.—AMMONIA.

AMMONIA may be taken as *Liquor ammonia*, or as *carbonate of ammonia* (hartshorn). Ammonia is recognised by its pungent odour, dense fumes given off with hydrochloric acid, and strong alkaline reaction.

Symptoms.—Being very volatile, it attacks the air-passages, and may cause death from inflammation of the larynx and lungs. When swallowed in solution, the symptoms are similar to those of soda and potash.

Post-mortem appearances.—Similar to other corrosives.

Treatment.—Vinegar and water. Other treatment according to symptoms.

Fatal dose.—One drachm of strong solution.

Fatal period.—(*Shortest*.) Four minutes.

XVI.—IRRITANTS. SALTS OF THE ALKALIES AND EARTHS.

The carbonates of ammonia, potash and soda have been treated of already. Iodide of potassium will be discussed under the heading of iodine, and binoxalate of potash under oxalic acid.

XVII.—NITRATE, SULPHATE, AND BITARTRATE OF POTASH.

NITRATE OF POTASH (nitre, sal Prunella), occurs in crystals, or cakes or balls (prunella balls).

Tests.—As for nitric acid.

Symptoms.—Irritation of alimentary canal, vomiting and diarrhoea, pain at pit of stomach, trembling of limbs, collapse.

Post-mortem appearances include marks of acute inflammation in stomach and intestines.

Treatment.—Emetics, stomach pump, stimulant drinks, ice.

Fatal dose.—One ounce.

SULPHATE OF POTASH.—(Sal polychrest, sal de duobus.)

Symptoms and post-mortem appearances as other irritant poisons.

Treatment.—As for nitrate of potash.

BITARTRATE OF POTASH.—(Argol, cream of tartar.) Has caused death in one case. *Symptoms*, those of an irritant poison with paralysis of lower extremities.

Treatment.—As for nitrate.

Fatal dose.—Two ounces.

XVIII.—ALUM, SULPHURET OF POTASSIUM.

ALUM.—(Sulphate of alumina and ammonia). This is not often taken as a poison. It occurs in crystalline masses, or white powder.

Symptoms and Treatment, as other irritant poisons.

SULPHURET OF POTASSIUM.—(Liver of sulphur.) Occurs in mass or powder of a dirty-green colour. Gives a yellow solution, and has a strong smell of sulphuretted hydrogen. The addition of acid liberates the gas, which may be detected by the usual tests.

Symptoms.—Of acute irritant poisoning, with stupor or convulsions. Excreta smell of sulphuretted hydrogen.

Post-mortem appearances.—Stomach and duodenum reddened, with deposit of sulphur. Lungs gorged.

Treatment.—Chloride of soda or lime in dilute solution, and ordinary treatment for irritant poisoning.

Fatal Period.—(*Shortest.*) Fifteen minutes.

XIX.—CHLORIDE OF SODIUM.

CHLORIDE OF SODIUM.—(Common salt).

Tests.—For the hydrochloric acid, nitrate of silver, which gives a white precipitate of argentic chloride; for the base, bichloride of platinum, which has a negative reaction.

Symptoms.—As of irritant poisoning generally.

Treatment.—As for nitrate of potash, (Aid xvii).

XX.—CHLORIDES OF LIME, SODA, AND POTASH.

These substances, used as bleaching powders and liquids, are all poisonous. They give off chlorine on the addition of an acid, smell strongly of that substance, and have powerful bleaching properties. The *symptoms*, &c., are the same as those of other irritants.

XXI.—BARIUM SALTS.

CHLORIDE OF BARIUM occurs crystallised in irregular plates, soluble in water and bitter in taste.

CARBONATE OF BARIUM is found native in massive radiated crystals, heavy and nearly colourless. It is found in shops as a fine powder, tasteless and colourless, insoluble in water, but effervescing with dilute acids.

Symptoms.—Besides those of irritants generally, violent cramps and convulsions, headache, debility, dimness of sight, double vision, noises in the ears, and beating at the heart.

Post-mortem appearance.—As of irritants generally. Stomach may be perforated.

Treatment.—Sulphate of soda or magnesia, emetics, and the stomach pump. Other treatment as for irritants.

XXII.—IRRITANT GASES.

These are, 1. Nitrous acid gas (see Aid X.) 2. Sulphurous acid gas. 3. Hydrochloric acid gas. 4. Chlorine. 5. Ammonia (Aid XV.) They have the common property of causing irritation and inflammation of the eyes, throat, and air passages, and may cause spasm of glottis.

SULPHUROUS ACID GAS : one of the products of combustion of common coal. Bleaching and antiseptic.

HYDROCHLORIC ACID GAS.—Irrespirable when concentrated, and very irritating when diluted. Very destructive to vegetable life.

CHLORINE.—Used in bleaching, and as a disinfectant. Greenish-yellow colour, suffocating odour. In poisoning, inhalation of sulphuretted hydrogen gives relief.

XXIII.—PHOSPHORUS.

PHOSPHORUS occurs usually in small waxy cylinders. Soluble in oil, alcohol, ether, chloroform, and carbon-disulphide; insoluble in water. Much used in rat-poisons made into a paste with flour, sugar, fat, and Prussian-blue. Also used for the tops of lucifer-matches. In "safety matches" the phosphorus is on the box.

Symptoms.—At first those of irritant poisons. Then vomiting of matters luminous in the dark, bilious or bloody, with garlic odour. Great prostration, diarrhoea with bloody stools. Then harsh, dry, yellow skin, erythematous spots, retention or suppression of urine, delirium, convulsions, coma and death. In chronic cases there is frequently caries of the lower jaw.

Post-mortem appearances.—Softening of the stomach, bloody spots on all organs, fatty degeneration of liver, kidneys, and heart, bloody urine, yellow skin, phosphorescent contents of alimentary canal.

Treatment.—Early use of stomach pump and emetics. Sulphate and carbonate of magnesia; mucilaginous drinks.

Fatal dose.—One grain.

Fatal period.—(Shortest.) Four hours.

Detection of Phosphorus in organic mixtures.—Mitscherlich's method is the best. Introduce the suspected material into a retort. Acidulate with sulphuric acid. Distil in the dark, through a tube kept cool by a stream of water. As the vapour passes over and condenses, a flash of light is perceived, which is the test.

XXIV.—IODINE AND IODIDE OF POTASSIUM.

IODINE occurs in scales of a dark bluish-black colour. It strikes blue with solution of starch, and stains the skin and intestines yellowish brown.

Symptoms.—Acrid taste, tightness of throat, epigastric pain, and then symptoms of irritant poisons generally. Chronic poisoning (iodism) produces irritation of alimentary canal, ptyalism, coryza, enlargement and tenderness of liver.

Post-mortem appearances.—Those of irritant poisoning with corrosion.

Treatment.—Stomach pump and emetics, carbonate of soda, amylaceous fluids, gruel, arrowroot, starch, &c.

Analysis of organic mixture containing Iodine.—Add bisulphide of carbon, and shake. The iodine may be obtained on evaporation as a sublimate. It will be recognised by the blue colour which it gives with starch.

IODIDE OF POTASSIUM.—Much used in medicine. A crystalline substance. Peculiar odour. Very slightly deliquescent.

Symptoms.—Small doses have sometimes produced effects. Vomiting and purging, griping abdominal pains, coryza, swelling of face, headache, dryness of throat, thirst. In less marked cases, symptoms of a common cold.

Treatment.—Emetics, stomach-pump, starch, &c.

Analysis.—Iodide of potassium in solution gives a bright yellow precipitate with a lead salt; a bright scarlet one with corrosive sublimate; and a blue colour with sulphuric or nitric acid and starch. In organic mixtures a current of hydrosulphuric acid gas should be passed through: this changes the free iodine into hydriodic acid. Drive off excess of gas, add potash in excess, filter and evaporate. Char the residue at low

red heat, powder the charred mass, treat with distilled water, and filter ; evaporate and apply acid and starch.

XXV.—ARSENIC AND ITS PREPARATIONS.

ARSENIC is the most important of all the metallic poisons. It is much used in medicine and the arts. It occurs as metallic arsenic, which is of a steel-grey colour, brittle, and giving off a garlic-like odour when heated ; as arsenious acid ; in the form of two sulphides, the red sulphide, or realgar, and the yellow sulphide, or orpiment ; and as arsenite of copper, or Scheele's green. It also exists as an impurity in the ores of several metals—iron, copper, silver, tin, zinc, nickel, and cobalt. Sulphuric acid is frequently tainted with arsenic from the iron pyrites used in preparing the acid.

Arsenious Acid.—(White arsenic, oxide of arsenic, &c.) Colourless, odourless, and almost tasteless. It occurs in commerce as a white powder and in a solid cake, which is at first transparent, but afterwards becomes opaque. Slightly soluble in cold water. The law requires that arsenic, when sold in quantities under ten pounds, shall be mixed with soot or indigo.

Symptoms.—Commence in about half-an-hour. Faintness, nausea, incessant vomiting, epigastric pain, headache, diarrhœa, tightness and heat of throat and fauces, thirst, catching in the breath, restlessness, debility, cramp in the legs and convulsive twitchings. The skin becomes cold and clammy. In some cases the symptoms are those of collapse, with but little pain, vomiting, or diarrhœa. In others the patient falls into deep sleep, while in a fourth class the symptoms resemble closely those of English cholera. The vomited matters are often blue or black, from the soot or indigo mixed with the poison.

The symptoms of *chronic* poisoning by arsenic are :

loss of appetite, silvery tongue, thirst, nausea, colicky pains, diarrhoea, headache, languor, sleeplessness, cutaneous eruptions, soreness of edges of eyelids, emaciation, anæmia and convulsions.

Post-mortem appearances.—Signs of acute inflammation of stomach, duodenum, small intestines, and colon. Stomach may contain dark grumous fluid. Putrefaction of the body is much retarded by arsenic.

Treatment.—The stomach-pump, emetics, then milk, milk and eggs, oil and limewater, &c. Inflammatory symptoms, collapse, coma, &c., must be treated on ordinary principles. As an antidote, the best is the hydrated peroxide of iron, formed by precipitating *tinctura ferri perchloridi*, with excess of ammonia.

Fatal dose.—(*Smallest.*) Two grains.

Fatal period.—(*Shortest.*) Twenty minutes. The effects of arsenic depend much on idiosyncrasy, some persons being able to take considerable quantities. The peasants of Styria are in the habit of eating it.

Tests.—Arsenious acid heated on platinum foil sublimes unchanged as a white smoke. Heated in a test-tube, small crystals will be obtained. Mixed with charcoal and heated in a test-tube, a metallic coating forms on the tube.

In *solution*, arsenic may be detected by the liquid tests. 1. Ammonio-nitrate of silver gives a yellow precipitate (arsenite of silver.) 2. Ammonio-sulphate of copper gives a green precipitate (Scheele's green.) 3. Sulphuretted hydrogen water gives a yellow precipitate.

Marsh's test.—Put the suspected liquid into a bottle with metallic zinc and sulphuric acid. Hydrogen is thus set free which decomposes arsenious acid, and forms arseniuretted hydrogen. The gas is carried off by a fine tube, and ignited. A piece of glass or porcelain held to the flame has a metallic ring deposited on it.

Reinsch's test.—Boil the suspected liquid with one-

sixth or one-eighth of hydrochloric acid, and introduce a slip of bright copper. If arsenic be present, it will form an iron-grey deposit. This can be obtained pure by reduction.

Other preparations of Arsenic—These are: arsenite of potash, (Fowler's solution), and arsenite of copper, (Scheele's green), frequently used in colouring dresses and wall papers. Persons employed in using it suffer from catarrhal symptoms, rash on neck, ears, and face, thirst, nausea, pain in stomach, vomiting, headache, &c. These preparations give the same reactions as arsenious acid.

XXVI.—ANTIMONY AND ITS PREPARATIONS.

The two preparations of antimony which are used as poisons are, tartar emetic and chloride of antimony.

TARTAR EMETIC—(Tartarised antimony, potassio-tartrate of antimony) occurs as a white powder, or in yellowish white efflorescent crystals. Vinum antimoniale contains two grains to an ounce of wine.

Symptoms.—Metallic taste, nausea, vomiting, burning heat and pain in stomach, purging. Dysphagia, sense of constriction in throat, intense thirst, cramps; in fatal cases giddiness and tetanic spasms. In chronic poisoning, nausea, vomiting and purging, weak pulse, loss of appetite, debility, cold sweats.

Post-mortem appearances.—Inflammation, softening and corrosion of throat, gullet, and stomach. In chronic poisoning, inflammation also of cæcum and colon. Brain and lungs may be congested.

Treatment.—Promote vomiting by warm greasy water; or the stomach pump may be used. Cinchona bark is the best antidote, and next to it, liquids containing tannin: as tea, decoction of oak bark, &c.

Fatal Dose.—In an adult, two grains.

Fatal Period.—From a few hours to some weeks.

Tests.—Soluble in water, but not in alcohol.

Heated in substance, it decrepitates and chars, and if heat be increased, the metal is deposited. Treated with sulphuretted hydrogen, a characteristic orange-red sulphide is formed.

A drop of solution evaporated, leaves crystals either tetrahedric or cubes with edges bevelled off. Sulphuretted hydrogen passed through, gives the orange-red precipitate above named. The mineral acids give a white precipitate, soluble in excess. From organic substances, antimony may be removed by Marsh's or Reinsch's process (see Aid XXV). Reinsch's test gives a violet deposit instead of the black lustrous one of arsenic.

CHLORIDE OF ANTIMONY.—(Butter of antimony.) A light-yellow or dark-red corrosive liquid.

Symptoms.—Violent irritation of alimentary canal, with the addition of narcotic symptoms. After death the mucous membrane of the entire canal is charred, softened, and abraded.

Treatment.—As for tartar emetic ; magnesia in milk.

XXVII.—MERCURY AND ITS PREPARATIONS.

The most important preparation of mercury, toxicologically speaking, is corrosive sublimate. Other preparations are calomel ; ammonio-chloride ; red precipitate, sulphide, cinnabar or vermilion ; subsulphate of oxide or turpeth mineral ; cyanide, and the two nitrates.

CORROSIVE SUBLIMATE (oxymuriate, chloride or bichloride of mercury) occurs as imperfect crystalline masses or white powder. Nauseous taste, soluble in 16 parts of cold, and three of boiling water. Soluble in alcohol and ether ; the latter also separating it from its solution in water.

Symptoms.—Acrid metallic taste, constriction and

burning in throat and stomach, nausea, vomiting of stringy mucus tinged with blood, purging. Feeble, quick, and irregular pulse. Cramp, twitches, and convulsions of limbs, occasionally paralysis. May be salivation, marked by brassy taste, peculiar foetor of breath, tenderness and swelling of mouth, inflammation, swelling and ulceration of gums, flow of saliva, loosening of teeth, &c.

Post-mortem appearances.—Corrosion, softening and sloughing ulceration of stomach and intestines. Inflamed condition of urinary organs, with contraction of bladder.

Treatment.—Encourage or produce vomiting. Albumen, as white of egg, gluten or wheat flour is the best antidote. Demulcent drinks, milk and ice. Stomach pump to be avoided if possible, owing to softened state of gullet and stomach.

Fatal dose.—Three grains in a child.

Fatal period.—Half an hour the shortest.

Tests.—The following table, from Dr. Husband's handbook, shows the reaction of corrosive sublimate with reagents.

1. With iodide of potassium.	1. Bright scarlet colour.
2. With potash solution.	2. Bright yellow colour.
3. With hydrosulphuret of ammonia.	3. First a yellowish and then a black colour.
4. Heated in a reduction tube.	4. Melts, boils, is volatilised, and forms a white crystalline sublimate.
5. With ether.	5. Freely soluble in ether; the ethereal solution, when allowed to evaporate spontaneously, deposits the salt in white prismatic crystals.
6. Heated with carbonate of soda in a reduction tube.	6. Globules of metallic mercury are produced.

XXVIII.—LEAD AND ITS PREPARATIONS.

The chief salts of lead producing poisonous effects are the acetate, subacetate, and carbonate.

ACETATE OF LEAD.—(Sugar of lead.) A glistening white powder or crystalline mass. Soluble in water, sweetish taste.

SUBACETATE OF LEAD.—(Goulard's extract), a whitish liquid. May be reddish.

CARBONATE OF LEAD.—(White lead, ceruse.) Heavy white masses, like chalk. Very insoluble in water. Easily acted on by acids.

Symptoms.—Metallic taste, dryness in throat, intense thirst, vomiting, colicky pains, cramps, cold sweat, constipation, scanty urine, and blue line on gums.

In chronic lead-poisoning the most prominent symptoms are blue line on gums, emaciation, pallor, quick pulse, constipation, colic, and paralysis of the extensors, causing "dropped hand."

Post-mortem appearances.—Inflamed mucous membrane of stomach and intestines, with layers of white or whitish-yellow mucus, impregnated with the salt of lead.

Treatment.—Sulphate of soda or magnesia. Milk, or milk and eggs. Emetics.—Iodide of potassium in chronic poisoning.

Fatal dose and fatal period.—Uncertain.

Tests.—Sulphuretted hydrogen gives a black precipitate; liquor potassæ, white precipitate; sulphuric acid, white precipitate insoluble in nitric acid; iodide of potassium, a bright yellow precipitate.

XXIX.—COPPER AND ITS PREPARATIONS.

Poisoning with copper salts is very rare. The most important are sulphate, subacetate, and arsenite.

SULPHATE OF COPPER (Bluestone, blue vitriol.)—In half-ounce doses is a powerful irritant. Has been given to procure abortion.

SUBACETATE OF COPPER (Verdigris).—Occurs in masses, or as a greenish powder. Powerful, astringent, metallic taste. Half-ounce doses have proved fatal.

ARSENITE OF COPPER.—(See arsenic).

Symptoms.—Epigastric pain, vomiting of bluish or greenish matter, diarrhœa. Dyspnœa, depression, cold extremities, headache. Jaundice is common.

Post-mortem appearances.—Inflammation of stomach and intestines, which are green in colour.

Treatment.—Encourage vomiting. Give albumen.

Tests.—Polished steel put into a solution containing a copper salt receives a coating of metallic copper. Ammonia gives a blue precipitate, soluble in excess. Ferrocyanide of potassium gives a rich red-brown precipitate. Sulphuretted hydrogen gives a deep-brown precipitate.

XXX.—ZINC, TIN, SILVER, IRON, BISMUTH, AND CHROME.

The preparations of zinc requiring notice are: sulphate and chloride.

SULPHATE OF ZINC in large doses causes dryness of throat, thirst, vomiting, purging and abdominal pain.

Post-mortem appearances.—Those of inflammation of digestive tract.

Treatment.—Tea, decoction of oak-bark, carbonate of potash, or soda as antidote.

CHLORIDE OF ZINC.—A solution containing this substance (200 grains to the ounce), constitutes "Burnett's disinfecting fluid." It is a corrosive poison.

TIN.—The chlorides of tin are used in dyeing, &c.

Tests.—Protochloride gives a dark brown precipitate with sulphuretted hydrogen; a grey precipitate with bichloride of mercury; a deep purple with chloride of gold. Perchloride gives a yellow precipitate with sulphuretted hydrogen; no precipitate with gold or corrosive sublimate.

Symptoms; are those of irritant poisoning generally; *treatment* similar.

SILVER.—Nitrate of silver is a powerful irritant.

Tests.—Black precipitate with sulphuretted hydrogen; white with hydrochloric acid.

Treatment.—Common salt.

IRON.—Sulphate of iron and perchloride of iron have proved fatal.

Tests.—Black precipitate with sulphide of ammonium. Greenish-blue precipitate with ferrocyanide of potassium.

Treatment.—Emetics and diluents; magnesia.

BISMUTH.—Subnitrate has proved fatal in two drachm dose. Often contains arsenic.

Test.—Deep-brown precipitate with iodide of potassium.

Treatment.—Emetics and emollient drinks.

CHROME.—Bichromate of potash, used as a dye, has been fatal more than once.

Tests.—Yellow precipitate with salts of lead, deep red with those of silver.

Treatment.—Emetics, magnesia and diluents.

XXXI.—NARCOTICS: OPIUM, AND MORPHIA.

OPIUM.—The inspissated juice of the unripe capsules of the *papaver somniferum* (N.O. *papavaraceæ*.) For the properties of opium, the reader is referred to any good work on *materia medica*. As a poison it is generally taken in the form of the tincture (*laudanum*). Opium is found in almost all so called “soothing-syrups” for children, and in Godfrey’s cordial and Dalby’s carminative. The most important active principles of opium are its alkaloid morphia and the acid meconic acid. The quantity of morphia found in opium varies from two to ten per cent.

Symptoms.—Usually commence in about twenty or thirty minutes. Giddiness, drowsiness and stupor, followed by insensibility. Patient seems asleep, may be roused by loud noise, but quickly relapses. Breathing becomes slow, and stertorous, pulse weak, countenance livid. As coma increases, pulse becomes slower and fuller. The pupils are either contracted or dilated, more frequently the former; and are insensible to the action of light. Bowels confined; skin cold and livid, or bathed in sweat. Nausea and vomiting are sometimes present. Remissions are not unfrequent, the patient appearing about to recover and then relapsing.

The habitual use of opium is not so uncommon as is often supposed, and opium eaters are able to take enormous quantities of the drug. The habitual opium eater may be known by his attenuated body, withered yellow countenance, stooping posture and glassy, sunken, eyes.

Post-mortem appearances.—Not very characteristic. Turgescence of cerebral vessels. May be serous effusion under arachnoid, into ventricles, at base and around cord. Rarely, extravasation of blood. Stomach and intestines usually healthy. Lungs gorged: skin livid.

Fatal period.—Three quarters of an hour, upwards.

Fatal dose.—Four grains of opium, smallest.

Treatment.—Stomach pump, emetics, strong coffee or tea, ammonia to nostrils, &c. Patient must be kept roused by dashing cold water over him, flagellating with a wet towel, walking about, &c. Treatment must be continued as long as any life remains.

Tests.—Opium itself cannot be directly detected, but we must test for morphia and meconic acid. These may be separated from organic mixture thus:—boil the organic mixture with distilled water, spirit,

and acetic acid; strain, and to the fluid passed through add acetate of lead till precipitate ceases. Filter. Acetate of morphia passes through and meconate of lead remains. Sulphuretted hydrogen sets free the meconic acid from the latter, throwing down sulphide of lead.

MORPHIA, or its acetate, gives an orange red with nitric acid; decomposes iodic acid, setting free iodine; with perchloride of iron, gives a rich indigo-blue; with bichromate of potash, a green turning to brown.

Meconic acid gives a blood-red colour with perchloride of iron, not discharged by corrosive-sublimate or chloride of gold. The similar colour produced by sulpho-cyanide of potassium and perchloride of iron is discharged by chloride of gold.

XXXII.—BELLADONNA, HYOSCYAMUS, STRAMONIUM, AND SOLANUM.

BELLADONNA.—The root, leaves, and berries of the *atropa belladonna* (N.O. Solanaceæ) are poisonous from the presence of an alkaloid atropia.

Symptoms.—Dryness of mouth and throat, intense thirst, dysphagia and dysphonia, quick pulse, delirium and stupor. Strangury and hæmaturia, and an eruption like that of scarlatina have been noticed. A marked symptom is dilatation of the pupil, which takes place whether the poison be taken internally or applied locally to the eye.

Post-mortem appearances.—Congestion of cerebral vessels, dilated pupils, red patches in alimentary canal.

Treatment.—Purgatives, emetics, charcoal.

Tests.—Atropia may be recognised by its action on the pupil.

HYOSCYAMUS (Henbane).—All parts of the plant, *H. Niger* (N.O. Solanaceæ), are poisonous from the presence of the alkaloid hyoscyamine.

Symptoms.—Giddiness, flushings, excitement, trembling of limbs and loss of power, pupils dilated. Fierce delirium, loss of speech, and exhaustion.

Post-mortem appearances.—Cerebral and pulmonary congestion.

Treatment.—Emetics and purgatives.

STRAMONIUM.—Thorn apple. All parts of the datura stramonium are poisonous. The alkaloid is daturia.

Symptoms.—Very similar to those of belladonna and hyoscyamus, the *post-mortem appearances* and *treatment* being also analogous.

SOLANUM NIGRUM, Black nightshade; **SOLANUM DULCAMARA**, Bitter-sweet or woody'nightshade; and **SOLANUM TUBEROSUM**, Potato, possess poisonous properties which reside chiefly in the berries and leaves. The symptoms are those of giddiness, dimness of sight, trembling of the limbs and delirium, with dilated pupils, vomiting and purging.

Treatment.—As for belladonna, &c.

XXXIII.—CAMPHOR.

A concrete vegetable oil, *Camphora officinarum* (N. O. lauraceæ). Poisonous in large doses.

Symptoms.—Languor, giddiness, dimness of vision, difficulty of breathing and delirium, with hot skin, flushed face and dilated pupil.

Post-mortem appearances.—Gastric and intestinal inflammation, injection of the meninges of the brain. Odour of poison throughout body.

Treatment.—Emetics and purgatives.

XXXIV.—COCCULUS INDICUS.

The fruit of *anamirta cocculus*. (N. O. menispermaceæ). Contains a poisonous alkaloid picrotoxine used to adulterate beer, and by poachers to catch fish.

Symptoms.—Nausea, vomiting, and abdominal pains, with stupor and complete loss of voluntary power.

Picrotoxine appears in fine white prismatic crystals, of an intensely bitter taste. Soluble in boiling water, alcohol and ether.

XXXV.—ALCOHOL, ETHER, CHLOROFORM, &c.

Alcohol, ether and chloroform, all induce narcotism, often preceded by delirious excitement, and followed by nausea and vomiting. When they cause death, it is by inducing a state like apoplexy, or by paralysing the heart,

ALCOHOL.—When pure a colourless volatile liquid (sp. gr. .795,) cannot be frozen, very inflammable.

Symptoms.—Acute poisoning, confusion, giddiness, headache, passing into stupor and coma. Vomiting may occur and recovery ensue, otherwise collapse sets in. Pupils usually dilated.

Chronic poisoning. Drunkards suffer from indigestion, vomiting and purging, jaundice, albuminuria, diabetes, cirrhosis of liver, degeneration of kidneys, congestion of brain, delirium tremens, insanity, paralysis, &c.

Post-mortem appearances.—Deep red colour of lining membrane of stomach. Sometimes congestion of cerebral vessels and meninges. Lungs congested, blood fluid. Rigor mortis persistent.

Fatal dose.—Uncertain.

Fatal period.—Average about twenty-four hours.

Treatment.—Stomach pump. Cold affusion. Ammonia. Galvanism.

Tests.—Smell. Dissolves camphor. With dilute sulphuric acid and bichromate of potash, turns green, and evolves aldehyde. Product of combustion makes lime-water white and turbid.

The following table condensed from Husband, gives

the points of distinction between concussion of brain, alcoholic poisoning, and opium poisoning.

CONCUSSION OF BRAIN.	ALCOHOL.	OPIMUM.
1. Marks of violence on head.	1. No marks of violence, unless person has fallen. History will be of use.	1. As alcohol.
2. Stupor, sudden.	2. Excitement precedes sudden stupor.	2. Symptoms slow. Drowsiness, stupor, lethargy.
3. Face pale, cold; pupils sluggish, sometimes dilated.	3. Face flushed; pupils generally dilated.	3. Face pale; pupils contracted.
4. Remission rare. Patient recovers slowly.	4. Partial recovery may occur followed by death.	4. Remission rare.
5. No odour of alcohol in breath.	5. Odour of alcohol.	5. Odour of opium in breath.

ETHER.—When pure, a limpid, colourless liquid, sp. gr. .735.

Symptoms.—When taken liquid, same as alcohol. When inhaled as vapour, causes slow, prolonged, and stertorous breathing; face becomes pale, lips bluish, surface of body cold. Pulse first quickens, then slows. Pupils dilated, eye glassy and fixed. Muscles become flabby and relaxed. Then pulse sinks and coma ensues, sensation being entirely suspended. Nausea and vomiting not uncommon.

Post mortem appearances—Brain and lungs congested. Cavities of heart full of dark, liquid blood. Vessels at upper part of spinal cord congested.

Treatment.—Exposure to pure air, cold affusion, artificial respiration, galvanism. In poisoning by the liquid form, stomach pump.

Tests.—Vapour burns with smoky flame, depositing

carbon. Sparingly soluble in water. With bichromate of potash and sulphuric acid same as alcohol.

CHLOROFORM.—A colourless liquid (sp. gr. 1.497), very volatile, giving off dense vapour. Sweet taste and pleasant odour.

Symptoms.—When swallowed, same as alcohol. When inhaled, much the same as ether, but produces insensibility and muscular relaxation more rapidly.

Post mortem appearances.—Cerebral and pulmonary congestion. Heart empty; or right side distended with dark blood.

Treatment.—Cold affusion; drawing forward tongue; artificial respiration; galvanism.

Tests.—Taste and odour. High specific gravity. Burns with green flame. Dissolves camphor, gutta percha, and caoutchouc.

CHLORAL HYDRATE.—Prepared from alcohol and chlorine.

Symptoms.—Deep sleep, followed by loss of consciousness. Pulse may become quick, and face flush. Prolonged use of this drug may produce a peculiar eruption on the skin, as first described by Dr. Husband. Supposed to act in the blood by being decomposed into chloroform and a formiate.

XXXVI.—NUX VOMICA, STRYCHNIA AND BRUCIA.

NUX VOMICA, as used in medicine, consists of the seeds of the *strychnos nux vomica*. From these seeds strychnia is obtained. The symptoms, post mortem appearances, and treatment of poisoning by nux vomica are the same as for strychnia.

STRYCHNIA is the alkaloid of nux vomica. It is a deadly poison, and forms an active ingredient in many "vermin killers." It occurs as a white powder or as a colourless crystal, with a very bitter and persistent

taste; very insoluble in water; more or less soluble in benzole, ether, and alcohol.

Symptoms.—Sense of suffocation, twitchings of muscles, followed by tetanic convulsions and opisthotonos. Face congested and anxious; eyes staring; lips livid. Much thirst, but no power of drinking, owing to spasm of jaws.

Post mortem appearances.—Heart empty, blood fluid, rigor mortis persistent. Hands usually clenched; feet arched and inverted. Congestion of brain, spinal cord, and lungs.

Treatment.—Emetics and stomach pump, followed by tannic acid, iodide of potassium, animal charcoal, nicotine, opium, and conia. Chloroform.

Fatal dose.—(*Smallest.*) $\frac{1}{4}$ grain.

Fatal period.—(*Shortest.*) Ten minutes.

Tests.—The alkaloid may be separated by Stas' process, and will then be found to be unaffected by sulphuric acid, but to give a purple blue colour, changing to crimson and light red, with peroxide of lead, or of manganese, bichromate, ferridcyanide or permanganate of potash. A very minute quantity ($\frac{1}{5000}$ grain) placed on the skin of a frog, after drying, causes tetanic convulsions.

BRUCIA.—This alkaloid found associated with strychnia, possesses the same properties, though in a less powerful degree. Nitric acid gives a red colour, changed to purple with protochloride of tin.

XXXVII.—CONIUM, PHYSOSTIGMA, ACONITE,

CONIUM MACULATUM.—Hemlock (*N.O. umbelliferæ*), contains the poisonous alkaloid conia, which is a volatile oil, of a mousy smell. Insoluble in water, soluble in alcohol, ether, and chloroform.

Symptoms.—Dryness of throat, headache, dilated pupil, dysphagia, loss of power passing into complete

paralysis. Delirium, coma, and convulsions occasionally.

Post mortem appearances.—Congested brain and lungs; redness of stomach.

Treatment.—Emetics, castor oil, diffusible stimulants.

Tests.—Deepened colour and dense white fumes with nitric acid. Pale red, deepening, with hydrochloric acid.

PHYSOSTIGMA.—(Calabar bean.) The bean from the *P. venenosum*. (N.O. leguminosæ.)

Symptoms.—Vomiting, giddiness, irregular cardiac action. Eyes bright, pupils contracted.

Treatment.—Emetics.

Test.—The contraction of the pupil which it causes.

ACONITE.—(Monkshood.) *Aconitum napellus*. (N.O. Ranunculaceæ.) Poisonous property depends on an alkaloid, aconitia.

Symptoms.—Numbness and tingling in mouth and throat, giddiness, loss of power, vomiting, and purging. Pupils dilated. Pulse small. Death often sudden.

Post mortem appearances.—Venous congestion, engorgement of brain and membranes.

Treatment.—Emetics, castor oil, animal charcoal, stimulants.

Fatal dose.—Of root or tincture, 1 drachm.

Fatal period.—Average, less than four hours.

XXXVIII.—TOBACCO, LOBELIA.

TOBACCO.—*Nicotiana tabacum*. (N.O. Solanaceæ) owes its poisonous properties to its alkaloid, nicotine, a volatile, oily, amber-coloured liquid, with an acrid taste and æthereal odour. Soluble in water, alcohol, ether, and chloroform.

Symptoms.—First, quickening and strengthening of the pulse, followed by giddiness, fainting, nausea, and vomiting, with syncope, stupor, stertorous breathing, and insensible pupil. Death has occurred after 17 or 18 pipes at a sitting.

Post mortem appearances.—Not uniform or characteristic. General relaxed condition of muscles; engorgement of cerebral and pulmonary vessels. Congestion of gastric mucous membrane.

Treatment.—Emetics, stimulants.

Fatal dose.—Half a drachm.

Fatal period.—(*Shortest.*) 18 minutes.

Tests.—No change of colour with the mineral acids. White deposit with corrosive sublimate. Precipitate with bichloride of platinum, and with carbazotic acid.

LOBELIA INFLATA—Indian tobacco, (N.O. Lobeliace) much used in America in asthma, and contains an alkaloid, Lobelin.

Symptoms.—Nausea, vomiting, giddiness, cold sweats, prostration.

Post mortem appearances and treatment.—As tobacco.

Fatal dose.—One drachm of powdered leaves.

Fatal period.—36 hours.

XXXIX.—HYDROCYANIC ACID.

PRUSSIC ACID is one of the most formidable poisons. When diluted with water it forms the ordinary acid of the druggist. A colourless liquid, feebly acid, with odour of bitter almonds.

Symptoms.—Giddiness, insensibility, convulsive breathing, clammy skin, dilated pupils, closed jaws. Muscles relaxed and flaccid. Breathing may be stertorous. Narcotic symptoms occasionally.

Post mortem appearances.—Skin livid, pale or violet. Hands clenched, nails blue. Jaws fixed, froth about mouth. Eyes prominent and glistening. Odour of acid from body. Venous system gorged.

Treatment.—Chlorine and the mixed oxides of iron are antidotes. Cold affusion, promotion of vomiting, ammonia.

Fatal dose.—About 45 minims of the B.P. acid.

Fatal period.—From two to five minutes after a large dose.

Tests.—With nitrate of silver a white precipitate evolving cyanogen with heat. Liquor potassæ and sulphate of iron give a brownish-green precipitate, which turns to Prussian-blue with hydrochloric acid. Liquor potassæ and sulphate of copper give a greenish-white precipitate, becoming white with hydrochloric acid. Bisulphide of ammonia gives sulphocyanide of ammonium, this develops a blood-red colour with perchloride of iron unchanged by corrosive sublimate.

XL.—OXALIC ACID.

OXALIC ACID, or acid of sugar, is often used by suicides, though not often by murderers.

Symptoms.—Sour taste, burning at pit of stomach, pain and tightness in throat. Mucous, bloody or dark coffee-ground, vomiting, purging and tenesmus, followed by collapse, feeble pulse, cold skin; also sourness of mouth, swelling of tongue, dysphagia, &c. In some cases cramps and numbness in limbs, pain in head and back, delirium, and convulsions.

Post mortem appearances.—Mucous membrane of mouth, throat, and gullet, white and softened. Stomach contains dark, grumous matter, and is soft, pale, and brittle. Intestines slightly inflamed. Stomach sometimes quite healthy.

Treatment.—Warm water freely; then chalk, carbonate of magnesia, &c. Not alkalies. Emetics, but not stomach pump.

Fatal dose.—(*Smallest.*) Three drachms.

Fatal period.—Has been almost instantaneous.

Tests.—White precipitate with nitrate of silver, soluble in nitric acid and ammonia. When dried and

heated on platinum foil, disperses as white vapour. Salts of lime in excess give white precipitate; soluble in nitric and hydrochloric acids, insoluble in ammonia.

BINOXALATE OF POTASH.—(Salt of Lemons, or salt of sorrel) occurs in many plants.

Symptoms, post mortem appearances, and treatment, as for oxalic acid.

XLI.—DIGITALIS.

All parts of the plant *digitalis purpurea*, purple fox-glove (N.O. Scrophulariacæ) are poisonous, from the presence of an alkaloid, digitalin.

Symptoms.—Nausea, vomiting, purging, and abdominal pains. Headache, giddiness, and loss of sight; pupils dilated, insensible; pulse weak, slow, and irregular; cold sweat. Salivation occasionally, or syncope and stupor.

Post mortem appearances.—Congested condition of brain and membranes; inflammation of gastric mucous membrane.

Treatment.—Emetics, aperients, infusions containing tannin, as coffee, tea, oak-bark, galls, &c. Stimulants.

Tests for digitalin.—A white substance, sparingly soluble in water, not changed by nitric acid; turns yellow, changing to green with hydrochloric acid; evaporated to dryness, and treated with sulphuric acid, yields a rose colour, turning mauve with vapour of bromine.

XLII.—CARBONIC ACID GAS, SULPHURETTED HYDROGEN, AND CARBURETTED HYDROGEN.

CARBONIC ACID GAS is generated in many ways. In fermentation; in burning lime; in the combustion of fuel, &c.

Symptoms.—Acts as irritant when pure; diluted, causes weight in forehead and back of head, giddiness, vomiting, somnolence, loss of power. Insensibility,

stertorous breathing, and death from apoplexy or apnoea. Convulsions occasionally.

Post-mortem appearances.—Body swollen and livid; countenance may be bloated or calm and pale. Limbs rigid, abdomen distended with gas. Right side of heart, lungs, and large veins gorged. Brain and membranes vascular.

Treatment.—Pure air, cold affusion, stimulants, artificial respiration, galvanism, inhalation of oxygen.

SULPHURETTED HYDROGEN is characterised by its odour, which is like that of rotten eggs.

Symptoms—Giddiness, pain and oppression of stomach, nausea, loss of power. Delirium, tetanus, and convulsions.

Post-mortem appearances.—Fluid and black blood, loss of contractility of muscles, rapid putrefaction.

Treatment.—Fresh air, stimulants, inhalation of chlorine.

Test.—Acetate of lead throws down a brown or black precipitate, according to the quantity of the gas.

CARBURETTED HYDROGEN.—(Coal gas.) Coal gas contains light carburetted hydrogen or marsh gas, olefiant gas, ammonia, sulphuretted hydrogen, carbonic acid, carbonic oxide, free hydrogen and nitrogen.

These gases have a very offensive odour, burn with a yellowish white flame, yielding water and carbonic acid.

Symptoms.—Foaming at mouth, vomiting, convulsions, tetanic spasms, stertorous breathing, dilated pupil.

Post-mortem appearances.—Pallor of skin and internal tissues; florid colour of neck, back, and muscles; fluid florid blood; infiltration of lungs.

Treatment.—Fresh air, cold affusion, diffusible stimulants.

XLIII.—VEGETABLE PURGATIVES.

The vegetable purgatives are aloes, colocynth, gamboge, jalap, scammony, seeds of castor oil plant, croton oil, elaterium, the hellebores, and colchicum. All these have, either alone or combined, proved fatal. The active principle in aloes is aloin; of jalap, jalapine; of white hellebore, veratria; and of colchicum, colchicine. Morrison's pills contain principally aloes and colocynth, and aloes is also the chief ingredient in Holloway's.

Symptoms.—Vomiting, purging, tenesmus, &c., soon, followed by cold sweats, collapse, or convulsions.

Post-mortem appearances.—Inflammation of alimentary canal; with ulceration, softening, and sub-mucous effusion of dark blood.

Treatment.—Diluents, opium, stimulants, abdominal fomentations, &c.

XLIV.—ABORTIVES.

The two vegetable substances principally used as abortives are savin and ergot.

SAVIN.—(*Juniperus sabina*.) N.O. Coniferae. Leaves and tops of the plant yield an acrid oil which possesses poisonous properties. Has produced death when used to procure abortion.

Symptoms.—As of irritant poisons (Aid IV., p 36). Purging not always present.

Post-mortem appearances.—Acute inflammation of alimentary canal. Green powder found. This washed and dried, and then rubbed, gives odour of savin.

Test.—A watery solution of savin strikes deep green with perchloride of iron.

ERGOT.—(*Secale cornutum*). A parasitic fungus attacking wheat, barley, oats, and rye, which has the power of causing contraction of unstriped muscular fibre and of the uterus.

Symptoms.—Lassitude, headache, nausea, diarrhœa. Small quantities frequently repeated produce gangrene of extremities.

Tests.—Lake-red with liq. potassæ; this liquid filtered gives a precipitate of same colour with nitric acid.

XLV.—IRRITANTS PRODUCING NERVOUS SYMPTOMS.

WATER HEMLOCK.—(Cowbane). Root has been mistaken for parsnip. Produces tetanus, dilated pupil, insensibility, coma, nausea, and diarrhœa. P.M. shows corrosion and perforation of stomach.

FOOLS' PARSLEY.—(*Æthusa cynapium*). Has been mistaken for parsley, and the roots for young turnips. Produces heat in mouth, nausea, and vomiting; headache, giddiness, stupour, dilated pupil, and locked jaw.

LABURNUM.—(*Cytisus laburnum*). Contains an alkaloid producing vomiting, foaming at mouth, and insensibility.

YEW.—Leaves and berries of *taxus baccata* act as irritant poisons. P.M. shows irritation of alimentary canal.

XLVI.—SIMPLE IRRITANTS.

ARUM.—(Cuckoo-pint; lords and ladies). All parts are acrid and irritating.

MEZEREON.—(*Daphne mezereum*). Bright red berries taken by children for currants.

RANUNCULUS.—(Buttercup; crowfoot). Every part of the fresh plant contains an acrid principle. Juice is a powerful vesicant.

BRYONY.—Two plants included under this head. *B. dioica*, N.O. cucurbitaceæ, and *Tamus communis*, N.O. Dioscoreaceæ. Both possess irritant properties, and, growing wild, may be eaten by children.

The symptoms, post-mortem appearances, and treatment of the above are the same as for irritant poisons generally.

XLVII.—MISCELLANEOUS.

CANTHARIDES.—The insect known as cantharis vesicatoria, or Spanish fly, contains a strong irritant poison which acts on the urinary and generative organs.

Symptoms.—Acrid taste, tightness in throat, burning in pit of stomach, dysphagia, bloody stools, and vomiting; priapism, strangury, convulsions and delirium.

Post-mortem appearances.—Those of great irritation. Portions of wings and wing cases may be found in stomach and recognised by microscope.

Treatment.—Emetics, warm liquids, castor oil. Diluents and opium.

Fatal dose.—One ounce of tincture.

Fatal period.—24 to 36 hours.

Tests.—Sulphuric or nitric acid produces no change of colour in cantharidine.

PUTRID ANIMAL MATTER.—This may produce symptoms of irritant poisoning, especially in the form of sausages, bacon, ham, cheese, and goose-grease.

Symptoms.—These usually come on after three or four hours, and are those of irritation in the alimentary canal, with occasionally collapse, or narcotic symptoms.

Treatment.—After removal of the poison, treat symptoms.

